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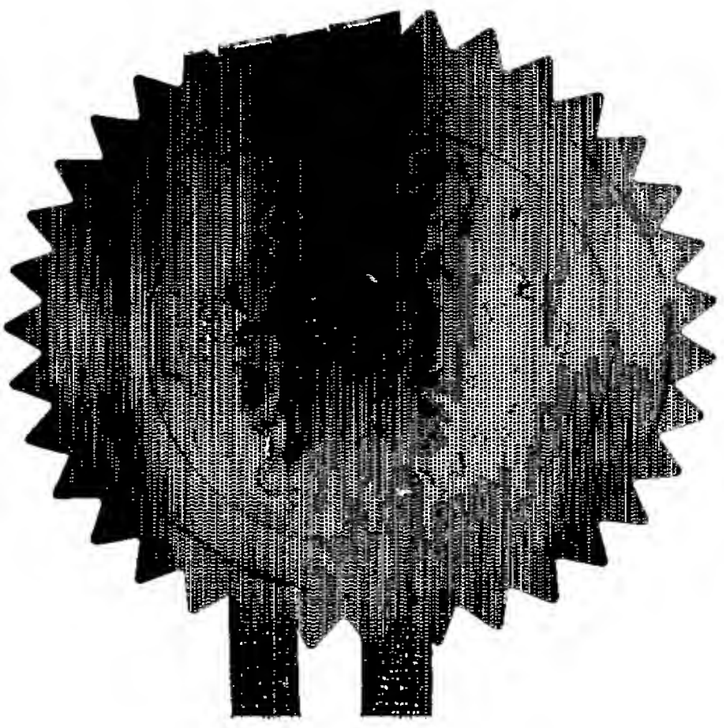

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6960983001

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4. Title of the invention

MODULAR INTERFACE STRAP FOR MULTI-UNIT WRISTBAND AND NECKLACE ASSEMBLIES

5. Name of your agent *(if you have one)*

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Signature(s) Simon Daniel Date 27/02/04

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

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MODULAR INTERFACE STRAP FOR MULTI-UNIT WRISTBAND AND NECKLACE ASSEMBLIES

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to a wearable modular strap device for supporting multiple module units which are electronically and mechanically connected to the strap and suitable for wearing on the person, either in a wristband configuration in one preferred embodiment or as a necklace in another. The present invention comprises a substantially flat flexible strap with a plurality of electrically connected nodes which act as connecting or docking points for removable and interchangeable modules. Said nodes contain connectors to enable electronic data and power connectivity between the strap and the attached module, and provides a mechanical clip mechanism to securely lock modules in place and a release mechanism to enable modules to be removed through a lateral sliding motion or changed without having to remove the wristband. Said strap contains a joiner clasp unit at each end suitable for easily securing the strap together at each end of the wristband or necklace, and containing a mechanism for varying the length of the strap. Said joiner clasp also containing a universal connector plug suitable for connecting the overall strap when open to a connector or port on an external device to facilitate data exchange, communication and power recharging. Said clasp containing suitable hub electronics and controller chips to manage connectivity to and between each of the individual connecting nodes and modular devices attached to the strap such that the strap can function both as a interface hub with multiple ports when open and as a personal wristband network when closed. Said removable modules would consist of at least a central unit capable of displaying information, a combined or separate unit suitable for control as a user interface, a rechargeable battery unit, and functional units for data storage, communication, external sensing and other electronic devices. Said removable module units could also consist of a dummy or filler unit suitable for covering the docking point where no functional unit was attached, and used largely to provide personalised ornamental design or simple patterned light effects across the strap.

2) Description of the Prior Art

There is substantial and diverse prior art relating to instances of wristwatch design, ornamental wrist watch strap design, jewellery bands as well as a growing range of patents on different electronic wristwatches focused on providing a single main unit that acts as communication devices, or radios, data storage, calculators, cameras, global positioning systems and/or health sensors. Some patents disclose a single main unit which utilizes a dedicated wrist strap for battery storage, antenna purposes or additional units, or to contain an external connector.

However, no such prior art has all the features described and claimed herein, and in particular none describes a modular wrist strap architecture for supporting a plurality of devices and suitable for extendable wearable computing with third party devices. As an example no such examined prior art discloses a modular wristband assembly for mechanically and electronically connecting removable units, neither do they show a wristband device architected as a distributed USB ('Universal Serial Bus') Hub with nodes and electronics distributed in a linear and modular strap configuration to provide a plurality of mini-USB type connector docking points across a wristband strap.

Furthermore, our invention provides an extendable architecture for customizing both the appearance and the function of the wristband by providing a simple mechanism for interchanging, upgrading and replacing modules as technology advances enable miniaturization and new functions on individual module components, without a need to replace the entire wristband.

By way of example U.S. Patent 6,249,487 by Yano et al (assigned to Casio Computer Co) filed July 1999, discloses a typical approach for compact miniaturization of an advanced electronic wristwatch application (a Global Positioning System watch in this case) in a single main instrument body with volume absorbed in the main device for power, display, control and device functions. Similarly, U.S. Patent 6,536,941 by Pang, filed April 2002, discloses a dedicated wrist worn personal Flash (Data storage device) constituting a main watch/storage device which is coupled through the strap to an external connector at the end of the strap. GB2364614 by Yong-Woo et al, (assigned to Samsung Electronics Co Ltd) describes a main instrument body containing a mobile phone with separate battery pack unit. Similarly U.S. Design Patent D466, 829 by Wada (assigned to Seiko) describes a typical design for a compact mobile wrist phone. U.S. Patent 4,847,818 by Olsen (assigned to Timex) describes a central main unit radio-telephone with wires connected through the strap to a connector clasp which contains a microphone and ear-piece at each end of the strap.

Some prior art teaches distributing a phone, battery and electronic functionality across the entire strap to form a single overall device. E.g. U.S. Patent 5,872,744 by Taylor (assigned to Motorola Ltd), describes a generic design of radio-telephony device where a main unit is connected to a series of hinged battery units or PC-boards that form the overall strap. U.S. Patent 6,212,414 by Alameh et al (assigned to Motorola Inc), filed April 1999 similarly describes a general approach for a dedicated radio telephony device which distributes battery and electrical components throughout the strap in order to reduce the size and electronics in the main unit which in this case is partly detachable, as well as suggesting potential incorporation of a recharging jack in the strap clasp. U.S. Patent 5,265,272 by Kurcbart describes a strap design that is assembled by modular interconnecting units (similar to a traditional jewellery band or metal watch chain strap) that form both a strap and could carry electrical connectivity and loop antenna suitable for incorporation with a central unit.

Examples of prior art with central main units linked to distributed strap units include WO9832057 by Caballe which describes a main unit instrument body with separate detachable modular side unit that connects directly into the main unit. WO0038393 by Fourie describes a generic design for a central watch/main processing unit, with additional detachable modules arranged around a strap. US 4,586,827 by Hirsch describes a wiring approach for a wristband information system where a central unit attaches mechanically to a plurality of wires in the strap, enabling the wires to act as antenna or connect directly to additional PC-board modules at different points of the strap. US 6,619,835 by Kita (assigned to Casio), filed May 2001, discloses a similar wristband system with a central unit connected to a custom removable strap containing wires which branch either side of the main unit and support extendable memory modules on one side and sensor modules on the other, controlled by circuitry in the central module, where said strap being unplugged from the central unit in order to slide on or change modules.

To the best of the applicant's knowledge, the prior art, whilst suggesting some features and numerous variations of wristwatch and portable wearable devices in general, the prior art has not disclosed some of the highly advantageous features of the present invention discussed herein.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide an extendable architecture for customizing both the appearance and function of advanced electronic wristband or necklace devices by providing a common modular framework for electrically and mechanically supporting a plurality of new devices, and to enable the customer rather than the supplier to select the features, functions and specification they desire as new modules become available as well as customize the overall appearance to individual style and fashions.

The wearable modular strap, of the present invention, in a preferred embodiment comprises a substantially flat flexible strap supporting a plurality of electrically connected nodes which act as connecting or docking points for securing multiple removable module units. Said nodes being connected by wires within the strap and preferably arranged in a longitudinal direction and containing connectors acting as a serial bus to enable electronic data and power connectivity between the strap and the attached module and containing local resistors, circuitry and capacitors within the node unit to facilitate hub port functions and power management such as limiting downstream current surges when hot-attaching a module. Said nodes providing a mechanical clip mechanism to securely lock modules in place and a release mechanism to enable modules to be removed through a lateral sliding motion or changed without having to remove the wristband, and a sprung positioning pin that could optionally be replaced with a screw accessible by removing the wristband for additional fixing. Said strap being affixed to a joiner clasp unit at each end suitable for easily securing the strap together at each end of the wristband or necklace when worn on the person, and containing a mechanism at one end for varying the length of the strap. Said joiner clasp connecting the strap wires to a universal serial bus connector plug contained within the clasp and suitable for connecting the overall strap when open to a connector or port on an external device to facilitate data exchange, communication and power recharging. Said clasp containing suitable hub electronics, clock and controller chips to manage connectivity to and between each of the individual connecting nodes and modular devices attached to the strap such that the strap can function both as an interface hub with multiple ports when open and as a personal wristband network between the modules when closed.

Said removable modules would consist of at least a central unit capable of displaying information, a combined or separate unit suitable for control as a user interface, a rechargeable battery unit or element within another module, and functional units for data storage, communication, external sensing and other electronic devices. Said removable module units could also consist of a dummy or filler cover unit suitable for covering the docking point where no functional unit was attached, and used largely to provide personalised ornamental design or simple patterned light effects across the strap. Said functional units could optionally contain additional advanced power management circuitry and capacitance depending on the requirements of the module as well as local memory, battery units, displays and interfaces.

Said overall wearable modular strap being connectable to a cradle or home port station by means of the universal connector for power recharging, and local functions where said cradle might connect to additional nodes for spare modules or mechanical racks for storing unused modules and filler cover

units. Said strap being available in different initial lengths to provide for a range of human wrist and necklace sizes or preferences.

Said overall wearable modular strap, in a preferred embodiment uses a Universal Serial Bus connector as the connector plug, and USB specification compliant Host, Hub controllers and circuitry in the clasp, with suitable power management circuitry and capacitance at the nodes acting as individual serial bus ports, with the four connectors within each node and associated wiring being two of power (a ground line and a Vcc line at +5v) and two of data (a serial data line and clock line), which preferably uses the standard NRZI (Non Return to Zero Invert) encoding scheme to send data with a sync field to synchronize the host and receiver clocks in the usual manner. Alternatively a similar implementation could be achieved using a Firewire Serial Bus system or other Serial Bus approach.

In a preferred embodiment when said overall wearable modular strap device is open and connected by means of the clasp USB connector clip to an external USB port, the external device would take on the role of USB host, whereas when the device is closed and used as a wristband it would act as a local host, using the circuitry on the clasp hub controller and/or circuitry embedded in say a single central interface module. The new USB 2.0 specification provides for greater design freedom in implementing more complex host functionality via the On-The-Go specification which introduces a host negotiation protocol, and there is also design flexibility from the original UHCI (Universal Host Controller Interface) and OHCI (Open Host Controller Interface) specifications as to the degree to which any advanced local host functions required are embedded in the hardware controller chips in the clasp and/or module circuitry or as software drivers in say a more advanced central control module.

A major benefit of the overall wearable modular strap using the USB standard is that each third-party module can follow a traditional architecture for serial bus communication, greatly facilitating the flexibility and integration of third-party module design as well as to provide a common method of data exchange using a preferred token-based protocol for any device on the wristband to access and use resources such as display/control/memory from any other attached module device. Additional circuitry could be added to the controller chip in the clasp to provide additional inter module functionality, such as a common store of connected devices and resources and additional buffer memory, or such circuitry could be embedded in a central display or interface unit configured to act as a local host.

Optionally a larger combination module could be attached and affixed on two connector nodes by sliding laterally as with a single module, with at least one connector acting for electrical and power connectivity. Such a module could be used as a central unit with advanced processing or large-scale electronics as miniaturization of radio-telephony devices and other advanced modules such as GPS may take some time. Equally a combination unit could provide scope for selecting a display, control and interface design from a preferred supplier or brand.

In a further alternative arrangement all the modules on the device could be simply battery units with an ornamental cover, thereby providing a battery magazine or portable power supply suitable for connecting into other wearable devices by means of a simple wire that could be embedded in one module and fold out to connect to the next wristband device or directly into clothing containing a

low voltage power membrane. Similarly users could wear multiple modular wristband straps, either on the same arm or on alternate arms which would provide more docking points for more modules, battery and functionality with potential inter-connectivity my means of a wireless communication module. This would be particularly relevant when travelling as users could carry additional batteries or storage, which might be relevant when say using a camera module. Likewise a module with removable lid could be produced which could hold a disposable battery or a battery could be custom produced with an equivalent receiving docking port such that it could be simply plugged directly onto the node on a strap.

A key benefit of the modular strap approach compared to existing prior art devices that focus around delivering a single device or dedicated main body/strap is that there are many potential wristband technologies, suppliers and third-party devices emerging with different product cycles which will take time to stabilize and be aggregated into single custom wristband devices, however, for the modular approach these emergent technologies could be incorporated faster as individual modular units as and when they become available, enabling a faster and more economic take-up by the consumer. Examples include compact data and media storage and players for MP3, wireless communication devices such as Bluetooth as well as compact radio-telephony units, digital radio, health/environment sensors, security tags, location sensors, cameras, microphones, flexible fold out screen displays, removable wireless earpiece connectors.

A further benefit of the modular approach is that it avoids the wasteful and rapid obsolescence of technology where users have to replace an entire wrist watch device to upgrade to a better specification or add a new function. This is likely to be of increasing benefit as environmental considerations raise user awareness about wasteful product cycles. An example of this is perhaps the short-lived product cycle for single unit camera watches which were largely superseded by mobile phones which incorporated camera elements, whereas a modular approach could have allowed adding a mobile unit, advanced camera or additional memory as and when the user required it and to their desired specification, or to replace a device with a smaller less clunky unit, which is a buyer value as technology miniaturizes. A further example is to avoid the problem of overall device obsolescence when a component fails or reaches its maximum lifetime (e.g. a battery with limited number of recharges), which could simply be architected easily as a removable or upgradeable module. The modular wristwatch strap is therefore expected to be a personal wristband which provides continuity across a range of devices the user selects rather than a single purpose product and therefore potentially has a longer product lifecycle than some individual module components.

Of particular benefit is the ability the modular strap offers for users to exchange modules with colleagues, or to possess additional modules and to adapt the wristband depending on their activity. By way of example a user might use a docking cradle at home to store a plurality of modular devices, and substitute a memory unit with say a GPS (Global Positioning System unit) when they go jogging, or to add a compass/emergency unit when they go camping. In a corporate context, users could carry project based data banks or security tags on the strap and exchange modules containing secure information or receive a welcome module with data when arriving at a location. Similarly conferences and retail stores could distribute modules containing custom data such as a sales material or conference packs, or sell music and media as an instant unit which could be attached to the wristband. In a vertical application such as a hospital or nursing home, health sensor modules could be added to monitor particular characteristics as and when they are needed, as well as being

able to substitute the communications module with an appropriate technology that works in that environment, office or country. Modules could also be recycled or sold when they are no longer needed by users.

Similarly a user might possess a compatible necklace or pendant strap and be able to substitute modules as they desire, with similar strap configurations being possible on a belt, in isolation as a cufflink when combined with an embedded wireless device, or as part of a sunglass frame side.

Accordingly the overall wearable modular strap device could therefore transform the wristband into a truly viable multi platform for portable wearable computing which could be adapted by the user for their specific functions and aesthetics.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate presently preferred embodiments of the present invention and together with the detailed description serve to explain the principles of the present invention.

FIG. 1 shows a three dimensional view of the wristband in a closed configuration, as it might appear on a wrist, with FIG 1A showing a wristband containing a full assembly of modules, FIG 1B a side elevation view through the wristband and FIG 1C a wristband strap with no modules.

FIG.2 shows a three dimensional view of the overall wearable wristband strap device in an open configuration, with FIG 2A showing the strap without any modules attached, FIG 2B a strap with several modules and a filler cap attached, and FIG 2C a cross-sectional view through the strap.

FIG. 3A shows a three dimensional exploded view showing the key components making up the overall wristband device assembly, with some modules removed.

FIG 3B shows a cross-sectional exploded view through the wristband strap and connector node.

FIG. 4A and 4B shows a side profile and plan view of the wristband strap device in an open configuration and supporting a plurality of module units.

FIG. 4C and 4D shows a side profile and plan view of the wristband strap device in an open configuration without any modules attached.

FIG 5A. shows a 3D profile of the wristband strap device in an open configuration showing a combination central unit, with FIG 5B and FIG 5C the respective side and plan views.

FIG 6. shows a 3D profile of the strap locking clasp, and component views showing this in an open FIG 6A, semi-closed FIG 6B and closed configuration FIG 6C.

FIG 7. shows a plan view of the strap locking clasp in an open configuration with the top sections removed for clarity with the lower image showing and an exploded view of the individual components.

FIG 8A. shows an exploded view of a wristband strap docking point and electrical and mechanical connector clips as well as an explosion of an example module. FIG 8B shows an enlarged 3D view of the base of an example module.

FIG 9. shows a three dimensional view of a necklace strap assembly with some modules partly removed for clarity.

FIG 10. shows an exploded view of a necklace strap docking point and electrical and mechanical connector clip as well as an example module.

DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the invention will now be described with reference to the accompanying drawings herein:

First Embodiment

Referring to FIG. 1A, which shows a 3-dimensional profile of an overall modular wristband device 1 in a closed configuration which comprises a flexible strap 2 connected to a clasp 3 which joins alternate ends of said strap so as to form a loop, where said strap 2 contains a plurality of removable modules 5 arranged at preferred regular intervals around the strap and secured by means of docking points or nodes 4 which serve to electrically and mechanically connect the strap 2 with the modules 5. FIG 1B shows a side view of said modular wristband device 1. FIG 1C shows a 3-dimensional profile of the wristband with all modules removed and more clearly shows the arrangement of docking nodes 4 in around the strap 2.

Referring now to FIG 2A, which shows a 3-dimensional profile of the overall modular wristband device in an open configuration with all modules removed with the substantially flat flexible strap 2 supporting docking nodes 4 and showing the male 6 and female 7 components of the locking clasp 3. FIG 2B shows the equivalent strap 2 with modules 4 attached which are shown as example function modules 8 with a central interface module 10 and display device 11 as well as an example ornamental filler module 9 which is smaller than other modules and serves to cover the docking node 4. FIG 2C shows a cross-section through the strap 2 showing the layers making up the overall docking node 4 which will be more clearly seen in FIG 3B and FIG 8, and a dotted cross-section showing the profile of an attached module 8.

Referring now to FIG 3 which shows an exploded view of the overall modular wristband device 1 and breakdown of the strap 2, docking node 4, module 8 and clasp 3 components in more detail. The Strap 2 comprises a top outer layer 13, an internal electrical membrane layer 14 and inner layer 16. Said top outer layer is made from a flexible material such as rubber or plastic and contains holes 30 at regular intervals with a partial ledge 70 and connecting to an external connector 19, which in a preferred embodiment is a USB connector, and supports circuitry 20 that contains at least one hub controller chip, and a plurality of resistors and other control circuitry. The middle layer 14 is a flexible membrane containing a plurality of wires connecting the connector 19 to the individual node circuit boards 15 arranged at regular intervals and capable of being assembled by sliding up

through the holes 30 in the top layer 13 and affixing to the ledge 70. The lower layer 16 is a flexible or rubber material which affixes within the recess formed on the bottom face of the top layer 13 and affixes to the bottom face of the membrane 14 and optionally through holes at intervals in membrane 14 to affix directly to the bottom face of 13. Said node circuit boards 15 support and electrically connect additional capacitors 59 and chips and resistors 60 suitable for local power management functions, and four electrical connector prongs 61 (as can be more clearly seen in FIG 8) as well as a locking hole 62. Said node circuit board 15 is preferably of rigid or semi-flexible material. Said node circuit boards 15 have a corresponding cover 12 made of a rigid or semi-flexible material that covers the circuit board and said capacitors 59 and chips 60 as well as provides slots through which the electrical connector prongs 61 protrude. Said cover also contains a rigid vertical prong 67 with shaped edges that serve to secure the modules 8 in place when connected. The overall assembly of cover 12 and circuit board 15 on the strap layers 13, 14, 16 thereby form the docking node 4 which serves to both mechanically and electrically connect to modules 8. A positioning pin 17 is also shown which would affix through holes 43 in the lower strap 16, and circuit board 15 hole 62 and cover 12 into the module. Such a positioning pin 17 would have a biased triangular bevelled end (Not shown) and be sprung such that it would compress when the overall module 8 is slid laterally, or be replaced with a small screw where modules are to be attached in a more permanent fashion in a screw thread within the module cylinder 57 (See FIG 8).

FIG 3 also shows the components of the locking clasp 3 which on one side has male 6 unit comprising a lid 18, USB port and circuitry 20 and base unit 21, and on the other has a female unit 7 formed from a lid unit 22 which is hinged and attached to base unit 23 as will be more clearly seen in FIG 6 and FIG 7. Also shown are example modules 8, a display module 11 and an example ornamental filler cap 9.

Referring now to FIG 4A and 4B which shows a plan and side profile of the overall modular wristband device 1 containing a series of modules 8 which in this instance are labelled as functional units 24, 25, 29 and control or interface unit 10 and display unit 11, along with an example filler cap unit 9. By means of example 24 could be a battery module, 25 a communication module and 29 an extended memory module. The control module 10 shows an example touch sensitive roll area 26 with central touch sensitive selector buttons 27. The display module 11 shows a screen 71 which for example might be an LED or LCD or OLED form, and could itself be touch sensitive, along with side control buttons 28. The filler unit 9 shows an example ornamental surface 64 that could optionally be a light emitted surface for patterned light effects or separately changeable when the module 9 is removed. FIG 4C and 4D show the corresponding plan and side profile for the overall modular wristband device 2 with no modules attached.

Referring now to FIG 5 which shows an overall modular wristband device 1 with a combination module 31 occupying two docking point nodes and four additional modules 8. Such an implementation might be chosen for highly complex devices yet to be miniaturized, or for style or user form factor reasons. Said combination module 31 could contain both display, user interface, memory storage and additional control functionality. Said module would slide laterally onto the docking point nodes and be connected electrically and mechanically in the same manner as single module 8, with the option that only one release mechanism might be needed. Said module 31 is shown with example control buttons 32 on the side.

Referring now to FIG 6 which shows the clasp 3 at various stages of operation, from an open form FIG 6A, to semi closed FIG 6B and closed FIG 6C. The action is such that the male clasp 6 is lifted over and secured within the lip 45 of the female clasp 7 whilst the lid 22 is open forming the assembly visible in FIG 6B. To release the clasp the side buttons 39 are compressed which would be attached to a flexible plastic prong 40 that unclips from recess ridge 41 such that the overall lid 22 can hinge upwards from base unit 23 enabling the male clasp 6 to be removed. This overall mechanism is designed so that it could be operated by one hand. By way of example a forefinger holding the strap 2 connected to the female clasp 7 against the underside of an inverted wrist whilst the thumb and middle finger hold the clasp 6 and hook it over the lip 45, with the forefinger then pushing down the lid 22 such that it clicks and locks via the prong 40 and ridge 41. Similarly the thumb and middle finger could be used to compress the buttons 39 to release the mechanism and then used in the same way to open the clasp.

Referring now to FIG 7 which shows a more detailed plan and exploded view of the clasp 6 mechanism, with the top diagrams showing a plan view of the open clasp and with the top lids 22 and 18 removed for clarity. This diagram more clearly shows the side button 39 on the top lid 22 of the female clasp 7 and the prongs 40 which would spring back slightly as it is pushed into the recess 41 in the lower base 23. Also shown is the hinge 38 between the upper lid 22 and the strap connector block 37 which attaches through the strap 2 to the base unit 23 by means of locking bolts 33 that pass through holes 34, 35 and 36 respectively. The oblong nature of the holes 35 in the strap provide one method of varying the length of the strap slightly as might be required by the user. For longer variations in strap length other straps could manufactured at different lengths with different hole 35 spacing or alternatively manufactured with one end being formed of plastic/rubber suitable for being cut down at point of supply and then connected to the clasp 7 in a similar manner. The hinge 38 on the strap connector block 37 could optionally be formed in the mould itself such that 22 and 37 form a continuous structure joined by a thinner more flexible plastic which would directly provide a small spring action, or could be a metal or other direct hinge. Similarly buttons 39 and prongs 40, could be formed as a continuous structure with the spring action created by a smaller width of plastic at the hinge axis. The overall outer surface of the clasp 6 and 7 is of a preferred rubber texture. The lower image shows the female clasp lip 45 and the male tongue 44 on the base 21 of clasp 6 lower which facilitates connecting the clasps together before the clasp is locked or released. An example circuit board 42 containing at least one integrated hub controller chip 20 attached to the USB connector 19 is also shown and would be connected directly to the internal strap membrane 14 for connectivity through to the individual docking nodes 4 and circuit boards 15.

Referring now to FIG 8 which shows an exploded view of a module 8 attached to the strap 2 and the components making up the strap docking node 4. The module 8 is positioned over the vertical prong 67 of the node 4 circuit board 15 and cover 12 by means of a slot 55 in the base 53 of the module 8. The act of pushing down the module has the effect of sliding the sprung locking bar 51 slightly as it makes contact between the curved edge form of the vertical prong 67 and the underside curve on the locking bar 51 without need to press the release button 52. The locking bar 51 position has a side profile 50 that then corresponds to the side profile of the vertical prong 67 such that the module can be slid laterally onto the rails 58 in the module base 53 which securely fasten the module to the strap node unit 4 by means of the edges of the vertical prong 67. The locking bar 51 then springs back locking the module 8 to the strap such that it cannot be removed unless the release button 52 is pressed and the module slid sideways and lifted off. Once the module is in place the sprung

electrical connectors 61 on the node circuit board 15 make contact with reciprocal connectors on the base of the circuit board 47 by means of a recess 56 in the module base 53 in a similar manner to a flash or phone SIM card. The vertical positioning pin 17, can also spring into place through holes 62 and 43, to provide additional stability or be replaced with a locking screw if required. The overall rectangular shape of the vertical prong 67 and hole 55 combined with the locking bar 51 is designed to provide rigidity to the module such that it won't twist or shear once in place on a wristband. An example circuit board 47 is shown covering the majority of the area of the module and supporting a plurality of chips 48 and containing a slot 49 for the module locking mechanism and node prong 67. Optionally the circuit board could support additional advanced power management circuitry such as larger capacitors, should the application require it. An example module lid 46 is also shown, though in practice this could be a screen, as in module 11 or a form of interface as in module 10. The module could be of different size or shape and is only limited by the spacing between docking nodes 4 on the strap and the fastening mechanism components 55, 58, 51. It will be appreciated that the lateral sliding fastening mechanism illustrated here as a preferred configuration could be adjusted in dimension or reformed as a rotational sliding or vertical locking mechanism, similarly the locking bar could be likewise adjusted. FIG 8B shows an enlarged view of the module base 53 showing the underside surface 54 and the internal structure more clearly showing the hole 55, locking rails 58 and side profile 50 of the locking bar 51.

Second Embodiment

Referring now to FIG 9. which shows a 3-dimensional profile of an overall modular necklace device 63 is a closed configuration which comprises a flexible strap 65 connected to a clasp 68 which joins alternate ends of said strap so as to form a loop, where said strap 65 contains a plurality of removable modules 8 arranged at preferred regular intervals around the strap and secured by means of docking points or nodes 4 which serve to electrically and mechanically connect the strap 65 with the modules 8. Said node units 4 are attached to the strap by means of a shaped base unit 66 which affixes to the strap 65 at each side. Said clasp 68 is similar to clasp 3 except has preferably rounded sides and is more shaped as might be suitable to rest at the back of a neck. Said overall modular necklace device 63 functions in a similar way to the modular wristband device 2 in that modules 8 are removable and interchangeable by means of the common docking points 4. Similarly a smaller cover filler cap 69 could be added to cover over an unused docking point 4, said cap 69 being of ornamental surface design and style.

Referring now to FIG 10 which shows a 3-dimensional exploded profile of a module 8 attached to the necklace strap 65 by means of a docking node 4. The module 8 contains a lid 46 and base unit 53 with internal circuitry and chips 48. Said module contains a locking bar 51 with external release button 52 attached to a plastic spring formed as part of the overall mould. Said bar 51 contains a side profile 50 that can allow the node prong 67 to slide under when attached, and locking rails 58 to sandwich the upper profile of the node prong 67 and secure it in place. The base 53 also contains a cylindrical hole 57 suitable for containing a locking screw or sprung positioning bolt. Key components of the node 4 are also shown, being the cover 12, the circuit board 15. The circuit board 15 would be attached via a membrane to the wires within the strap wire 65. A node base unit 66 is shaped to encase the lower side of the node 4 and secure the strap wire 65 on either side. Said base unit 66 plays the same role as the overall strap sections 2 (formed from 13, 14, and 16) in the modular watch strap.

Although the invention is described and illustrated with reference to one preferred embodiment a wristband and another arrangement as a necklace it is expressly understood that it is in no way limited to the disclosure of such preferred embodiments, but is capable of numerous modifications within the scope of the claims. By way of example the strap could be produced with a different number of docking points at different spacing, similarly the docking point could be used in other wearable devices such as on a pendant, belt or directly on clothing. By way of further example the mechanical docking point could be implemented in a rotational manner, or as a vertical release mechanism.

CLAIMS

What is claimed is:

1. A wearable modular interface strap device comprising:

a plurality of mechanical and electrical interface docking points arranged around a flexible strap capable of supporting a plurality of removable modules

a clasp at each end of said strap to close and fasten the overall device as a loop such that it could be worn on the person

a strap containing a plurality of wires which electrically connects each of the said docking points to an external connector embedded within said clasp and circuitry to enable data communication between docking points and attached modules

docking points that provide a mechanical mechanism to enable said modules to be easily attached and locked, and removed without opening the strap, and an electrical mechanism and circuitry to enable power and data connectivity with an attached module such that it could be removed or attached without electrical disruption to other modules

removable modules which are capable of providing a plurality of electrical device functions that could act to provide battery power, display information, act as control circuitry, act as data storage, act as a user interface, perform external sensing, perform communication functions and be extendable for other functions

filler units of largely ornamental appearance which would serve to cover any docking points not used by modules

2. A wearable modular interface strap device according to Claim 1 where said strap is arranged as a modular wristband comprising a substantially flat and flexible strap supporting a plurality of mechanical and electrical docking points for attaching a plurality of removable modules and suitable to be worn as a loop on a wrist and secured by means of a clasp at each end and capable of being connected to an external device by means of an external connector when open

3. A wearable modular interface strap according to Claims 1 to 2 where said electrical interface between strap docking point and module is a serial bus interface comprising at least four metal prongs for power, ground, data and clock line connection between wires in the strap and circuitry in the module

4. A wearable modular interface strap according to Claims 1 to 3 where said overall device can act as a hub when open and connected via an external connector for the purposes of recharging and data-exchange with an external host device, by means of control circuitry in the clasp, and local control circuitry attached to each docking point

5. A wearable modular interface strap according to Claims 1 to 4 where said overall device can act as a local network when not attached to an external device for the purposes of data-exchange and for access to resources on modules attached to other docking points on the strap, by means of host control circuitry in the clasp and local power management circuitry in the docking point and attached modules.

6. A wearable modular interface strap according to Claims 1 to 5 where mechanical means in the docking point and module base enable a module to be slid laterally and locked into position on the strap without removing the strap from the person, and to be released by pressing a sprung button attached to a locking means

7. A wearable modular interface strap according to Claim 6 where said module locking mechanism is accomplished by means of a locking bar in the module that has an underside profile that matches a vertical prong profile on the strap docking point and the module has a hole and adjacent locking rails that secure the vertical prong when the module device hole is positioned down over the vertical prong and slid laterally. Said sprung locking bar being displaced by the action of positioning and sliding the module over the vertical prong, which then springs back locking the module in place.

8. A wearable modular interface strap according to Claim 5 where additional locking can be provided by means of a sprung positioning pin or screw affixed to the module through holes in the strap.

9. A wearable modular interface strap according to Claims 1 to 8 where said docking point is assembled in layers comprising a circuit board electronically connected to a wire membrane in the strap and a cover for encasing local circuitry, chip and capacitance, where said cover contains a vertical prong shaped to be suitable for mechanically connecting to an attached module

10. A wearable modular interface strap according to Claims 1 to 9 where said strap is assembled in layers from an upper layer that is semi-flexible containing holes to support the docking point circuit boards, and a flexible interior membrane layer containing wires connecting to an external connector in the clasp and connecting to and supporting the docking point circuit boards, and a lower layer for sealing the whole unit as a strap.

11. A wearable modular interface strap according to Claims 1 to 10 where said Clasp is formed from a male component containing a lid, universal connector, control circuitry and chips, and a lower base unit, and a female component comprising a hinged lid and lower base unit, where said female clasp contains a locking block for attaching to the strap at various points and thereby varying the strap length

12. A wearable modular interface strap according to Claims 1 to 11 where said clasp contains a tongue on the male component and a lip or groove on the female component such that the male clasp can hook over the female clasp as the clasp is being connected and a hinged lid with release buttons that folds down, encases and secures the overall assembly

13. A wearable modular interface strap according to Claims 1-12 where a module contains at least a locking mechanism suitable for connecting to the docking point, connector plates for connecting to the four metal serial bus connectors on the docking point when the module is attached, and a circuit board containing at least one chip.

14. A wearable modular interface strap according to Claims 13 where said module could be a combination unit occupying two docking points on the modular strap and using at least one set of serial bus connectors and being slid laterally into place as with a single module and preferably containing at least a display, interface device and control circuitry.

15. A wearable modular interface strap according to Claims 1-13 where all modules are battery units with at least one battery unit containing a wire for connecting to another wearable device such that the whole assembly acts as a power-pack wristband

16. A wearable modular interface strap according to Claims 1-14 where at least one modular unit provides wireless communication such that any device on the strap can communicate wirelessly with an external device

17. A wearable modular interface strap according to Claims 1-16 in combination with a docking station suitable for recharging the device and supporting additional electrically connected and spare modules

18. A wearable modular interface strap according to Claims 1-16 where said ornamental filler module could have an interchangeable lid capable of other style forms and capable of using the power lines and battery power within the strap for LED or electroluminescent light effects.

19. A wearable modular interface strap device according to Claim 1, 3-16 where said strap is arranged as a modular necklace comprising a tubular flexible strap supporting a plurality of mechanical and electrical docking points for attaching a plurality of removable modules and suitable to be worn as a loop around a neck and secured by means of a clasp at each end and capable of being connected to an external device by means of an external connector when open

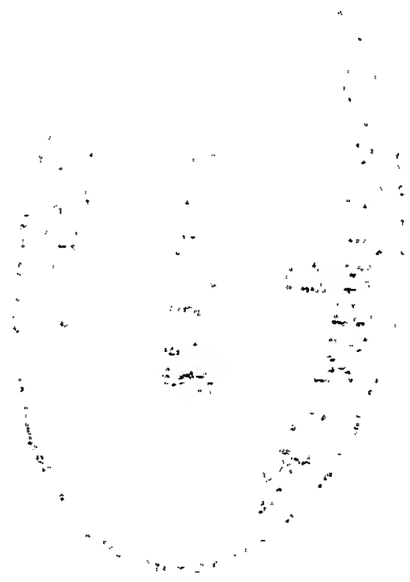
20. A wearable modular interface device according to Claim 1, 3-16 where said strap is arranged with a plurality of docking points on a pendant, belt, cuff-link or glasses frame.

21. A wearable modular interface strap device arranged as a wristband and comprising a substantially flat and flexible strap supporting a plurality of mechanical and electrical interface docking points arranged around a flexible strap capable of supporting a plurality of removable modules, with a clasp locking means at each end to close and fasten the overall device as a loop such that it could be worn on the person, where said strap contains a plurality of wires which electrically connect each of the said docking points to an external connector embedded within the clasp and circuitry to enable data communication between docking points and attached modules, where said wristband can

act as a hub for the attached modules when open and as a local network for connectivity between modules when closed, with said docking points providing a mechanical mechanism to enable said modules to be easily attached and locked, and removed laterally by means of a release mechanism without opening the strap, and said docking points providing a serial bus electrical mechanism and circuitry to enable power and data connectivity with an attached module such that it could be removed or attached without electrical disruption to other modules, where said modules are capable of providing a plurality of electrical device functions and includes at least one battery unit, at least one display unit, at least one interface unit, and at least one memory and control unit and could include at least one module filler unit acting to encase a docking point interface not in use by a module.

22. The ornamental design for a modular interface wristband device according to Claims 1-18 substantially as herein described above and illustrated in the accompanying drawings

23. The ornamental design for a modular interface necklace device according to Claim 19, substantially as herein described above and illustrated in the accompanying drawings



ABSTRACT

Abstract Title:

MODULAR INTERFACE STRAP FOR MULTI-UNIT WRISTBAND AND NECKLACE ASSEMBLIES

A wearable modular strap device for supporting multiple module units comprising a flexible strap with a plurality of electrically connected nodes acting as docking points to serial bus interface and mechanically connect removable modules, with the strap being lockable in a loop using a mechanical joiner clip that contains hub circuitry and a universal connector plug for recharging and data-exchange and means for varying the strap length. Said strap containing a plurality of wires to connect said plug to each of the electrical nodes being arranged in a linear membrane to be wearable as a wristband or arranged in an alternative wire configuration to be wearable as a necklace. Said modular strap device capable of supporting a series of interchangeable modules including a display device, a control device, a rechargeable battery, and a plurality of functional modules suitable for communication, data storage, location and environment sensing, or for ornamental purposes.

(Suggest use figure 1A and 1C as main drawing to accompany Abstract on first page)

Figure 1

Figure 1a

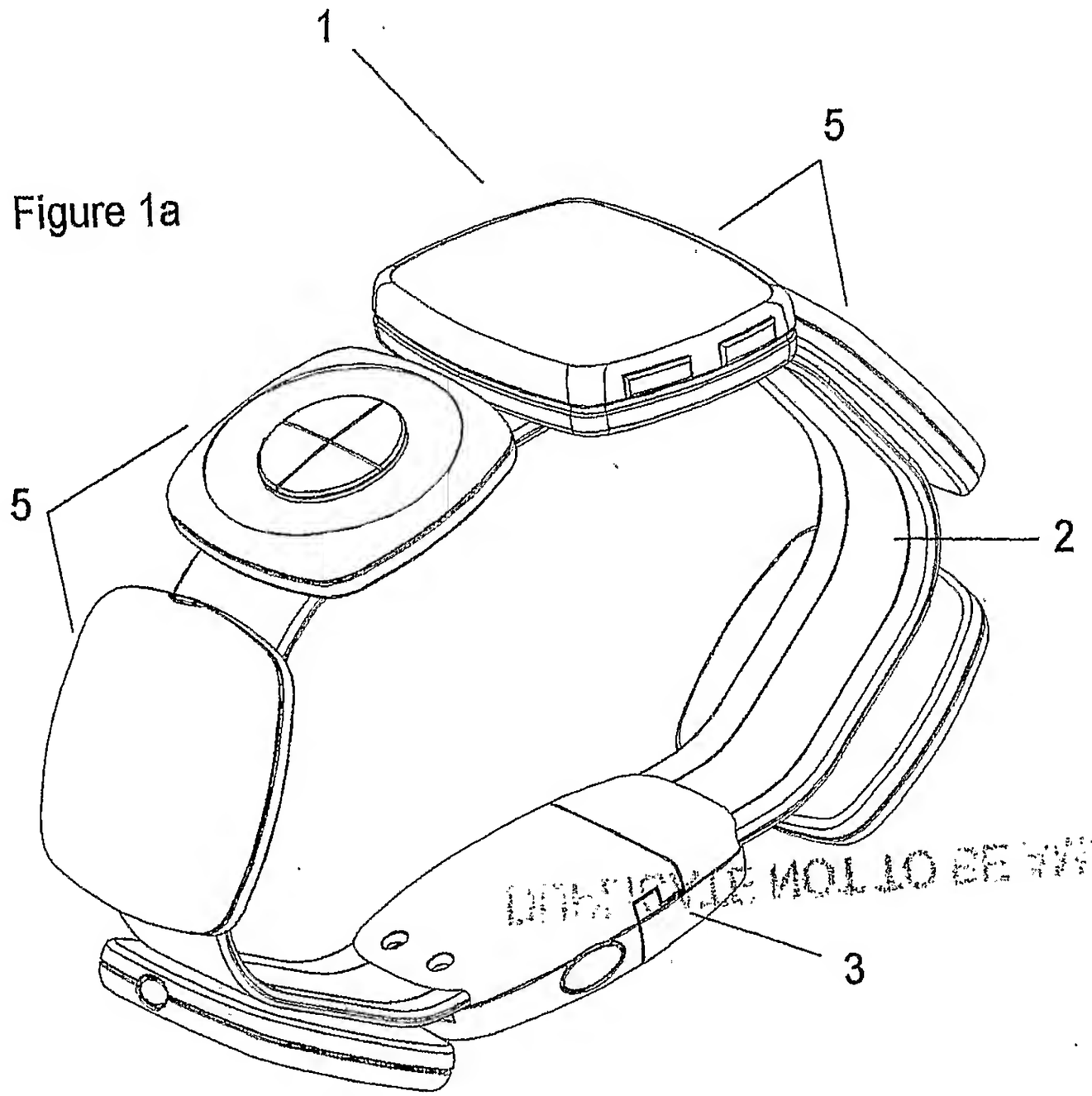


Figure 1c

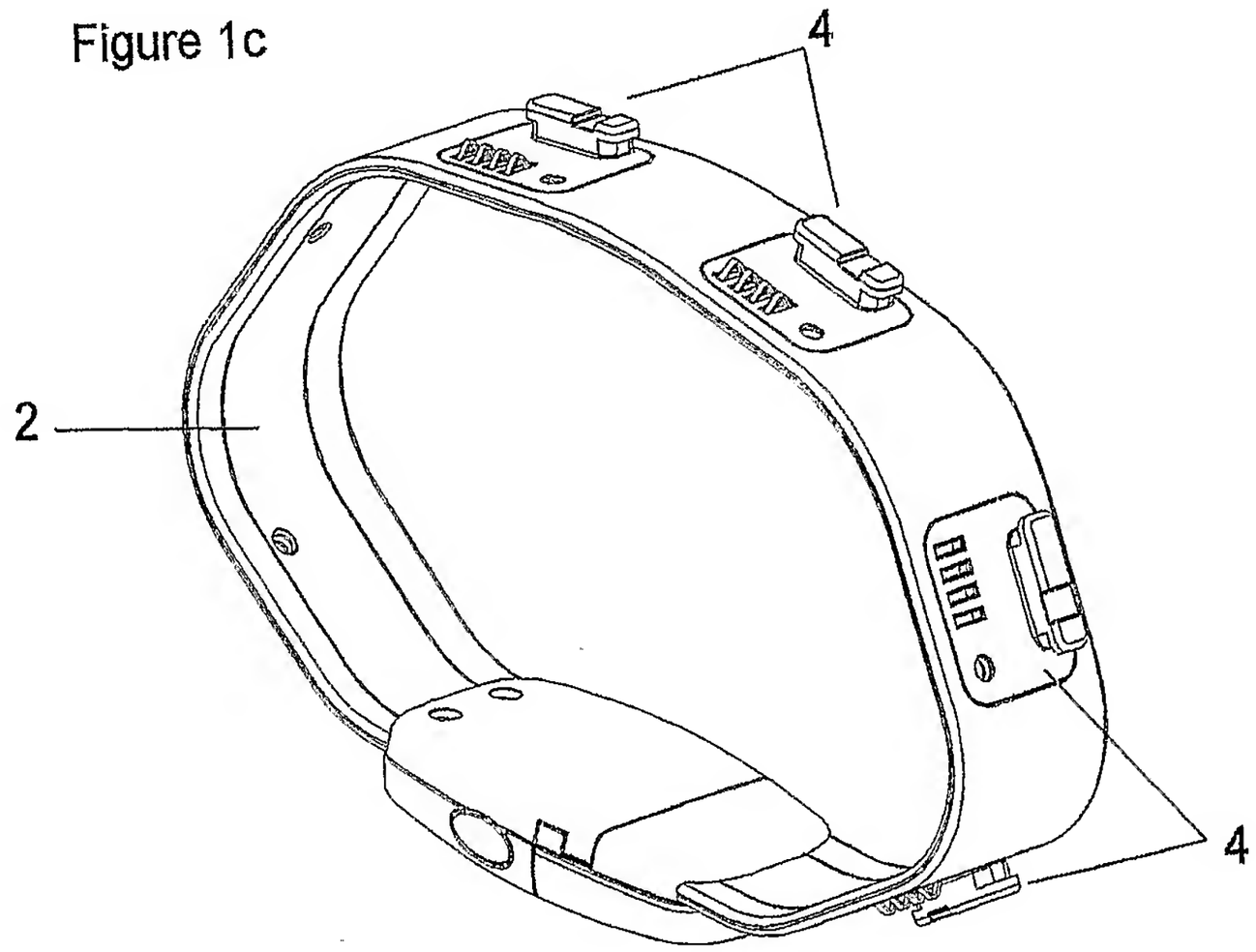


Figure 1b

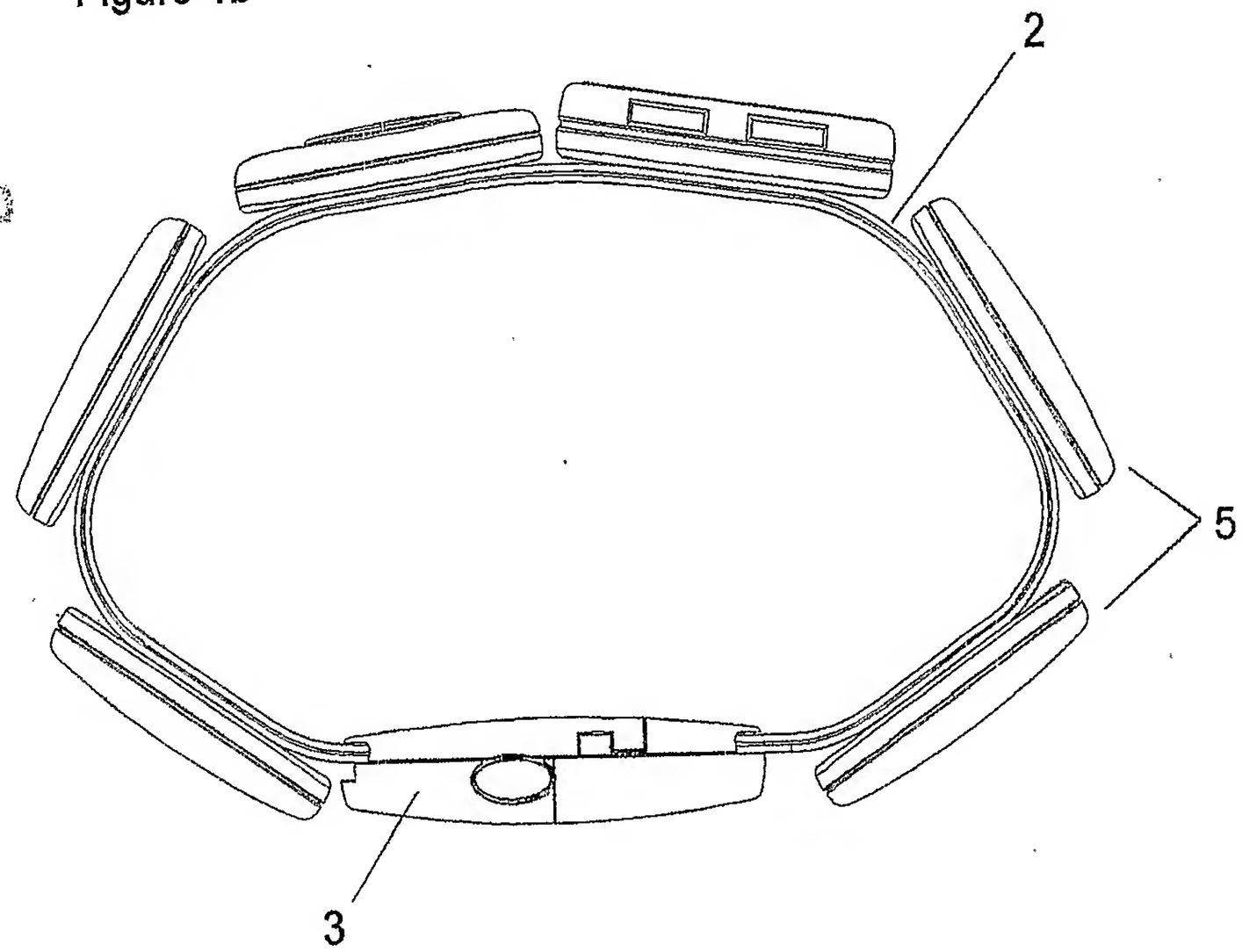


Figure 2

Figure 2a

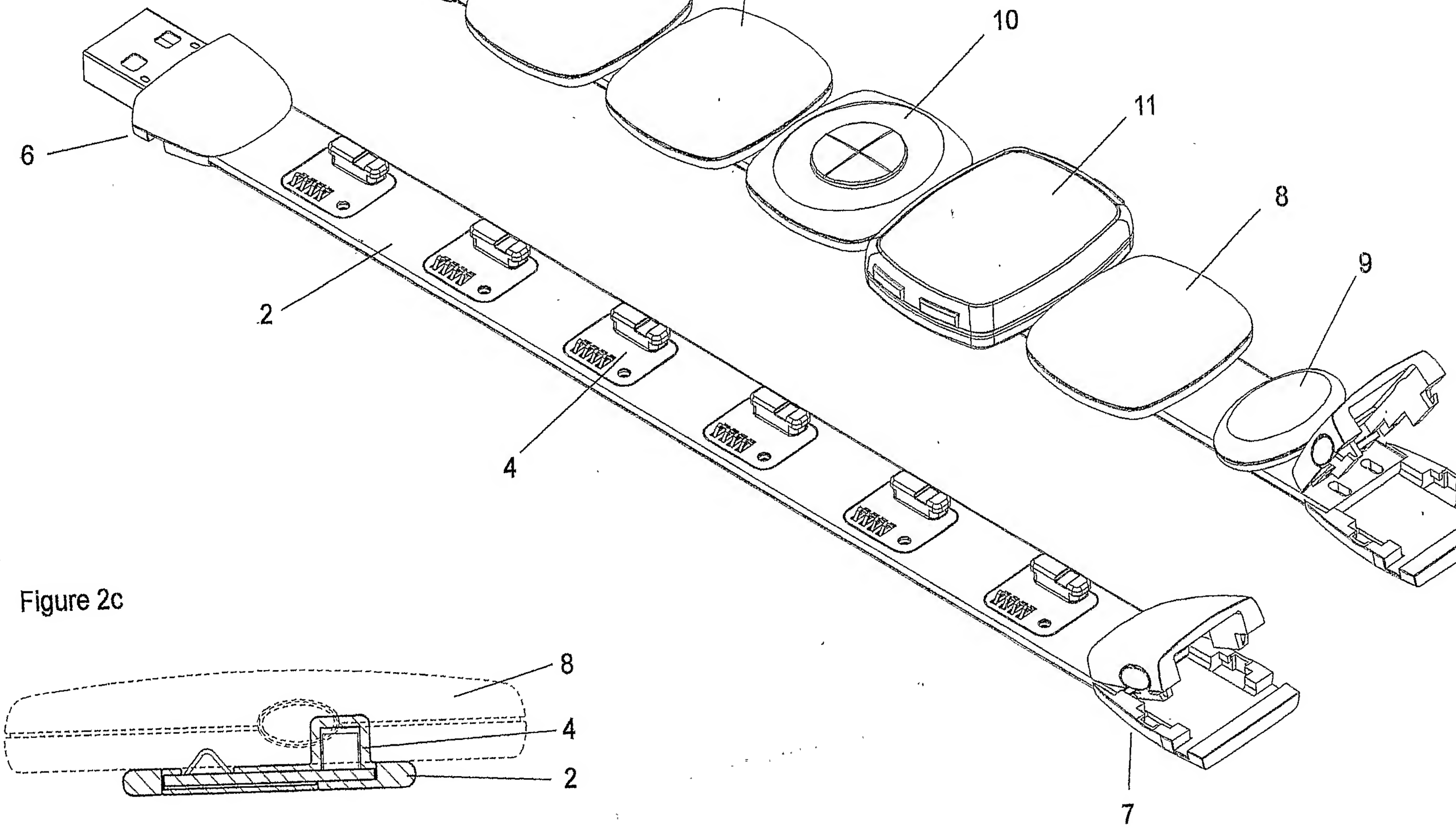


Figure 2b

Figure 2c

Figure 3

Figure 3a

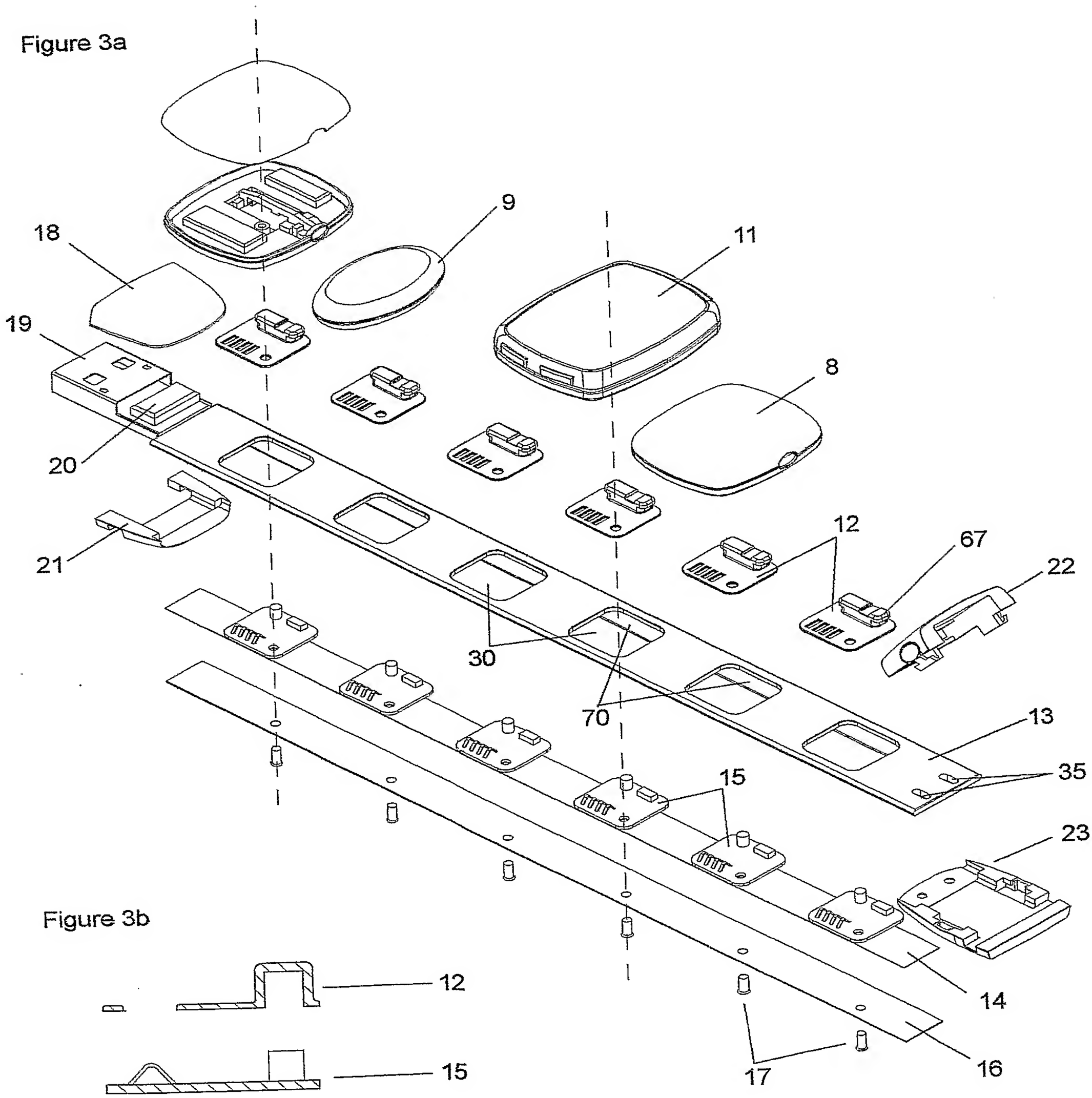


Figure 3b

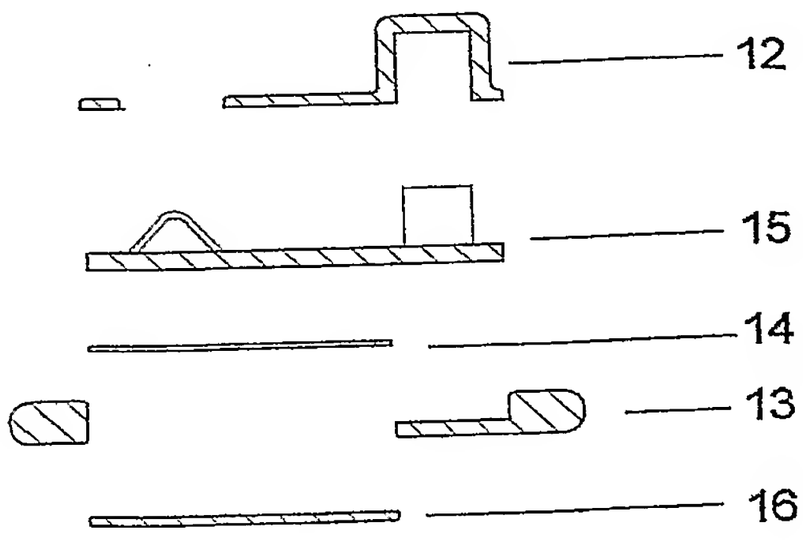


Figure 4

Figure 4a

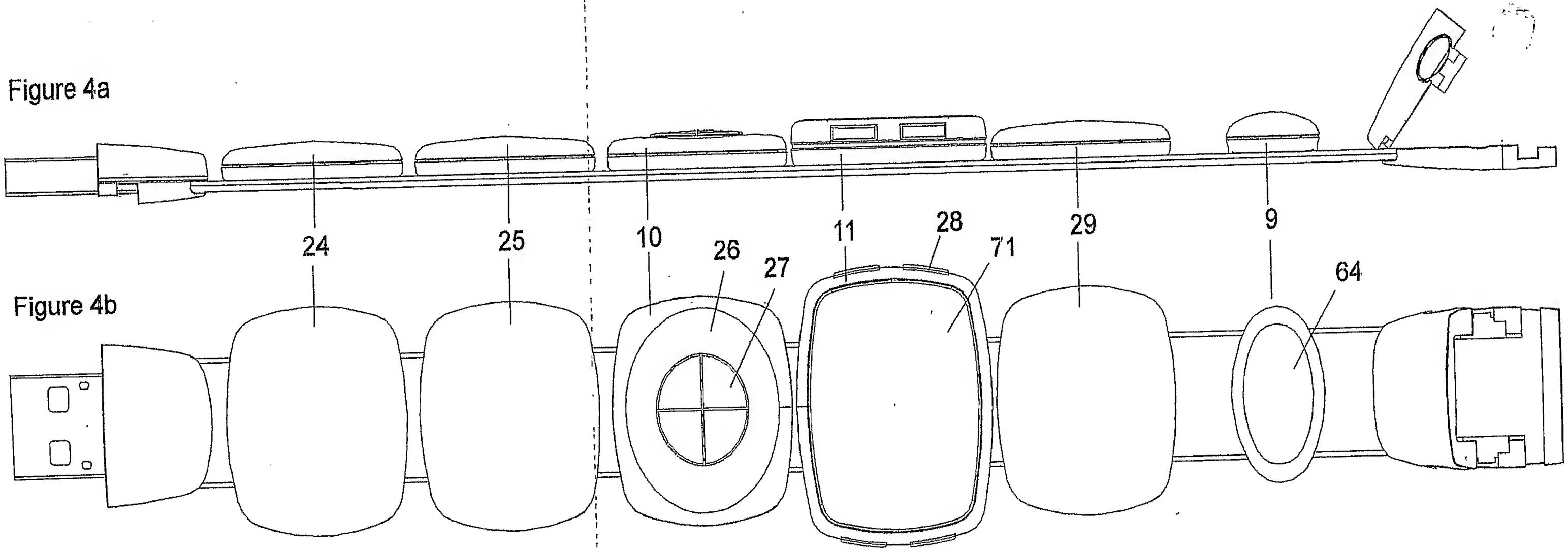


Figure 4b

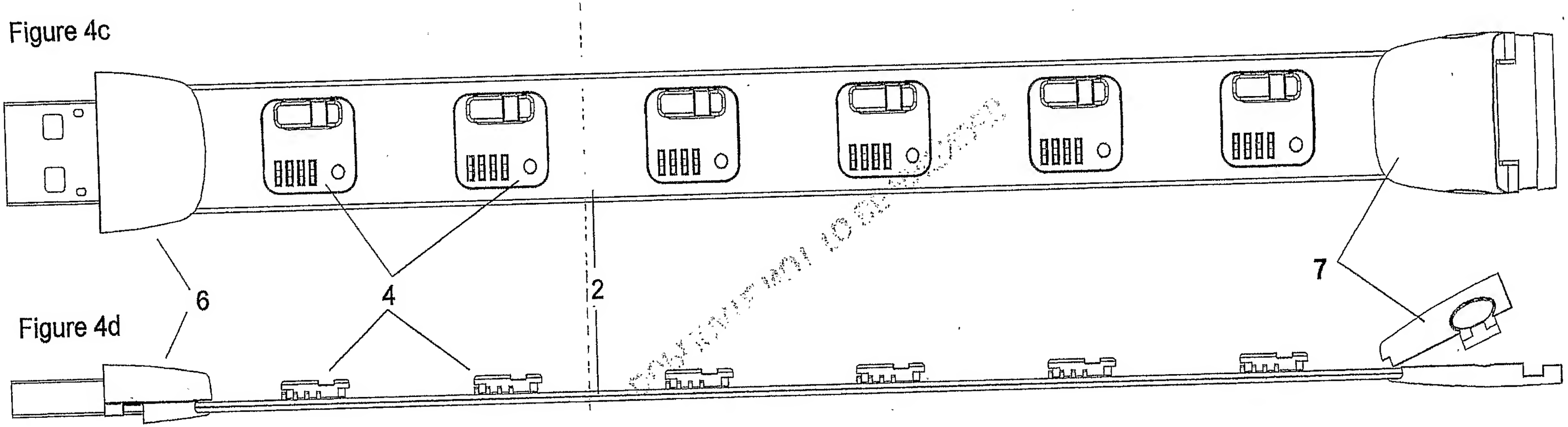
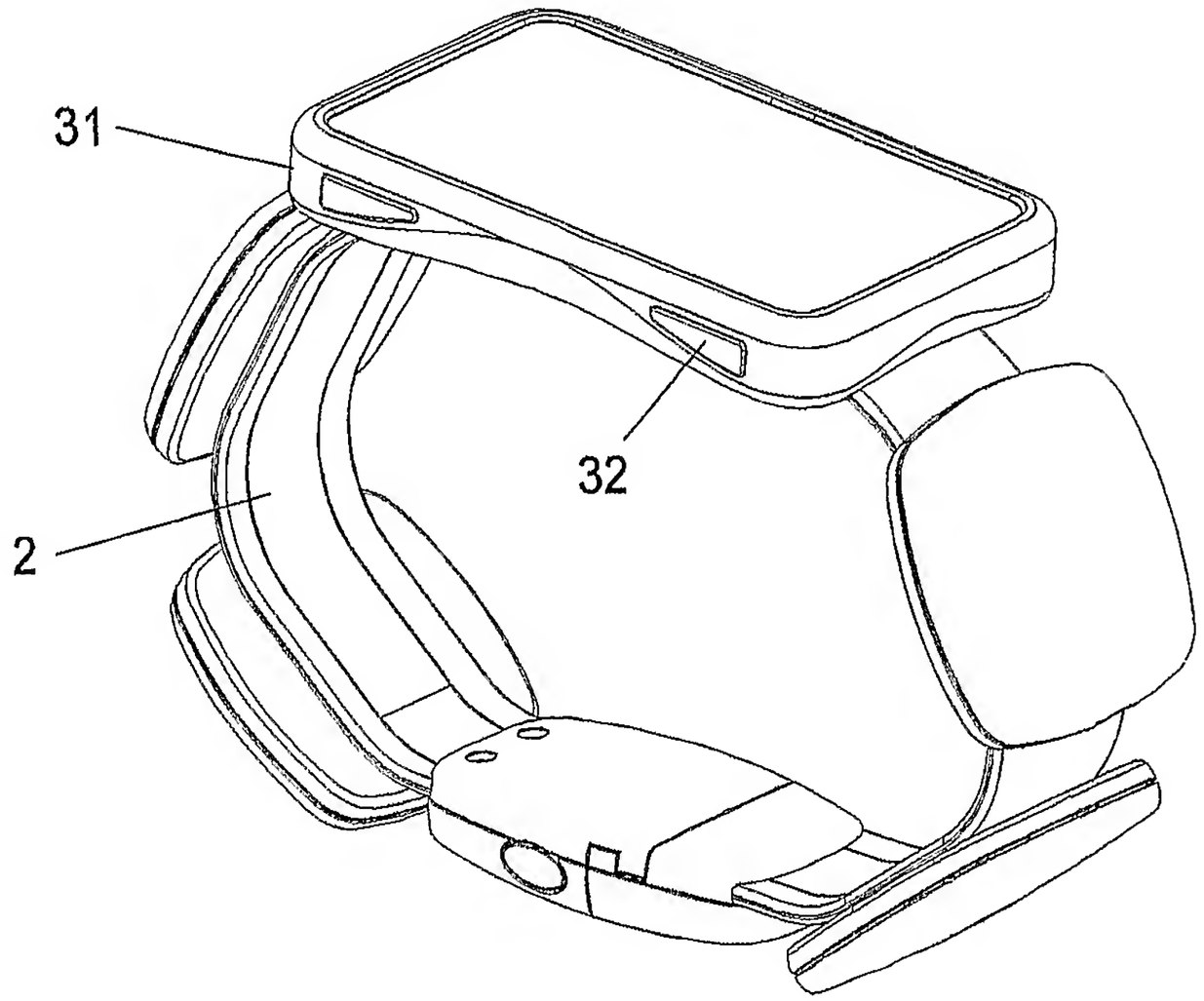


Figure 4c

Figure 4d

Figure 5



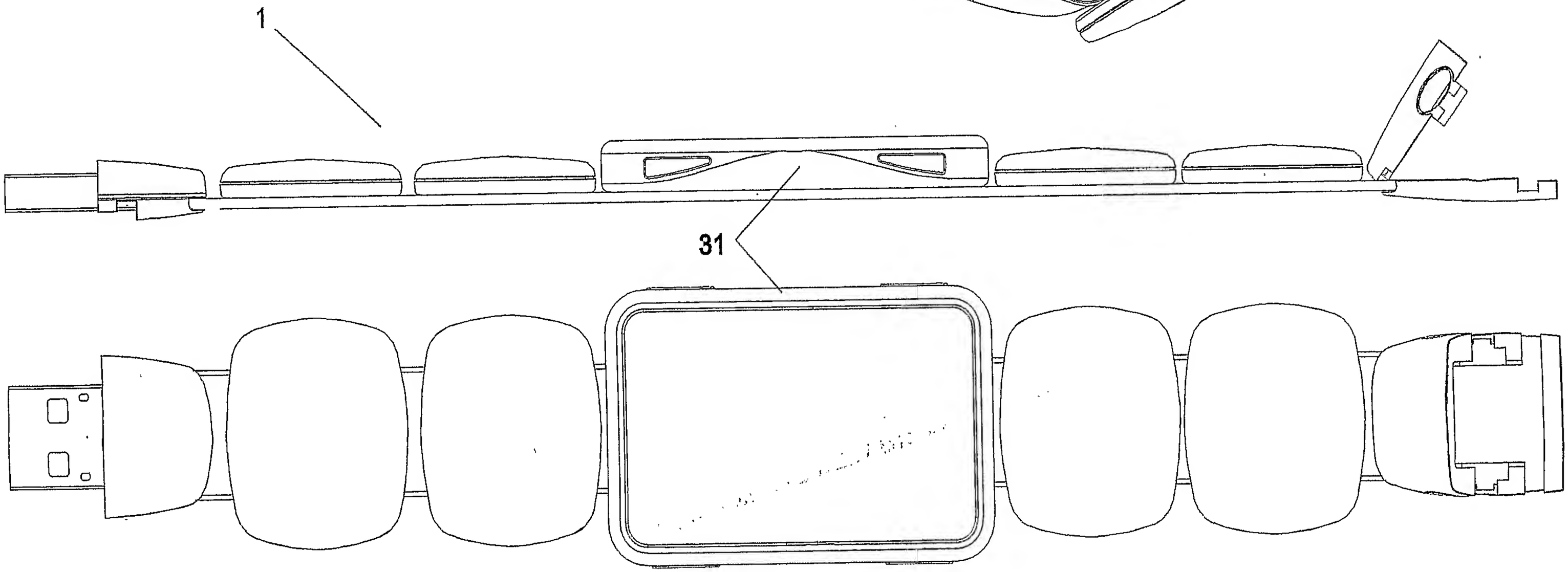


Figure 6

Figure 6a

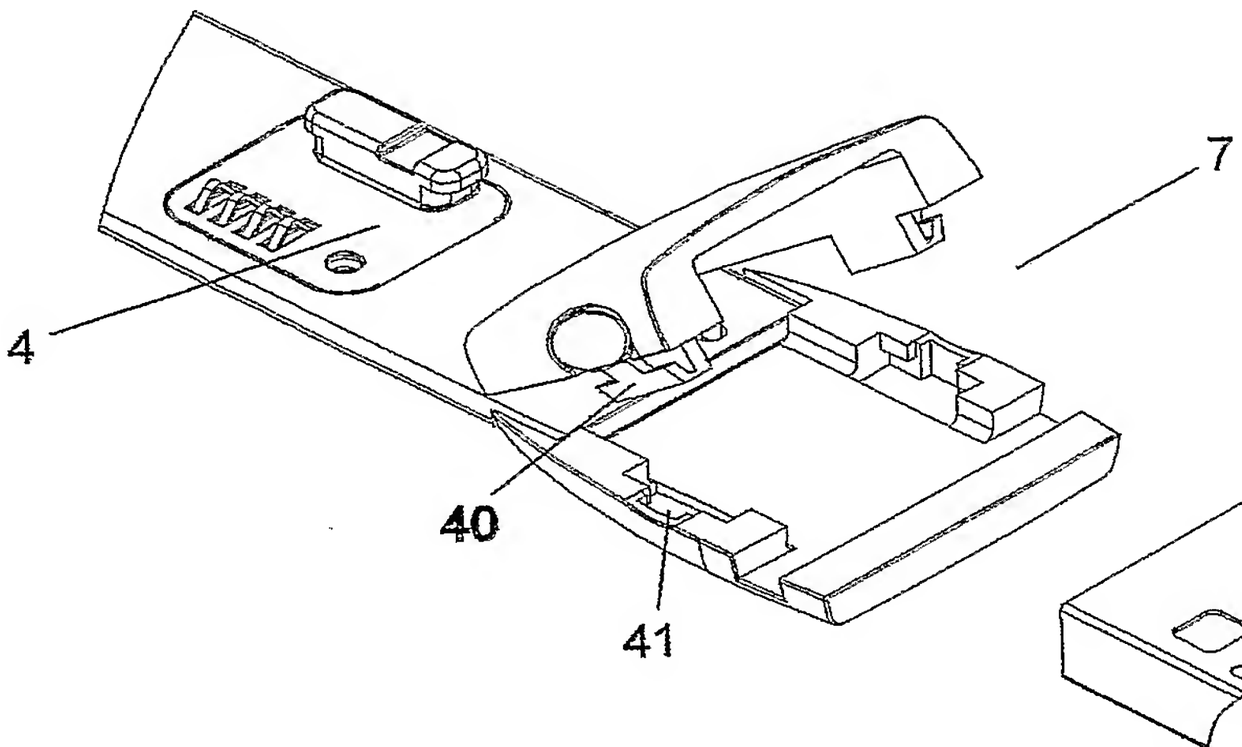


Figure 6b

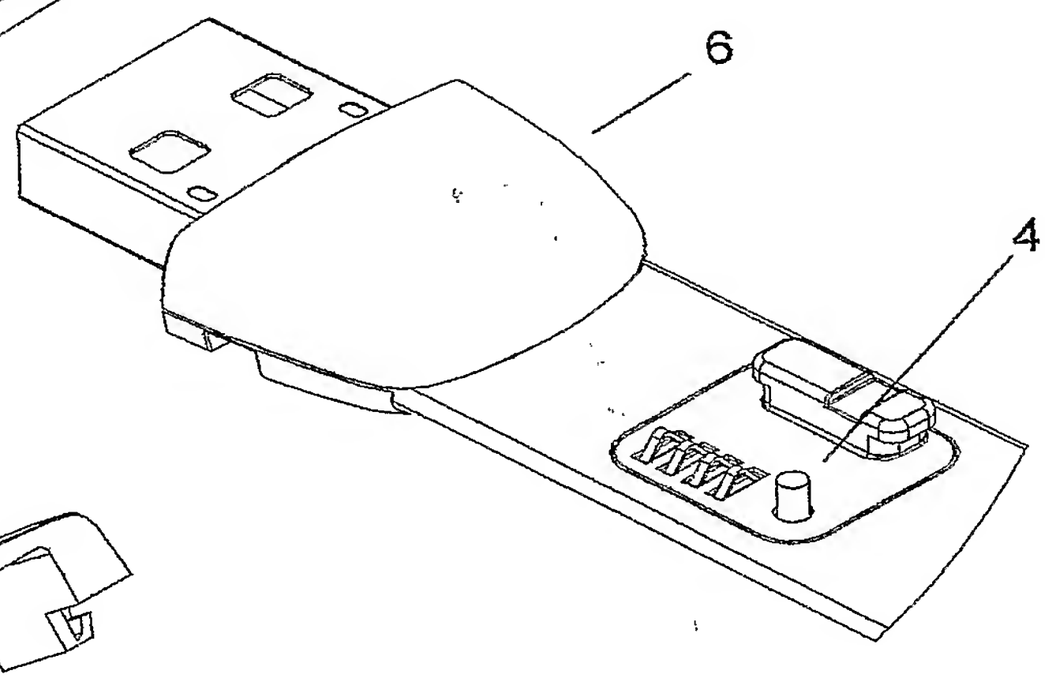


Figure 6c

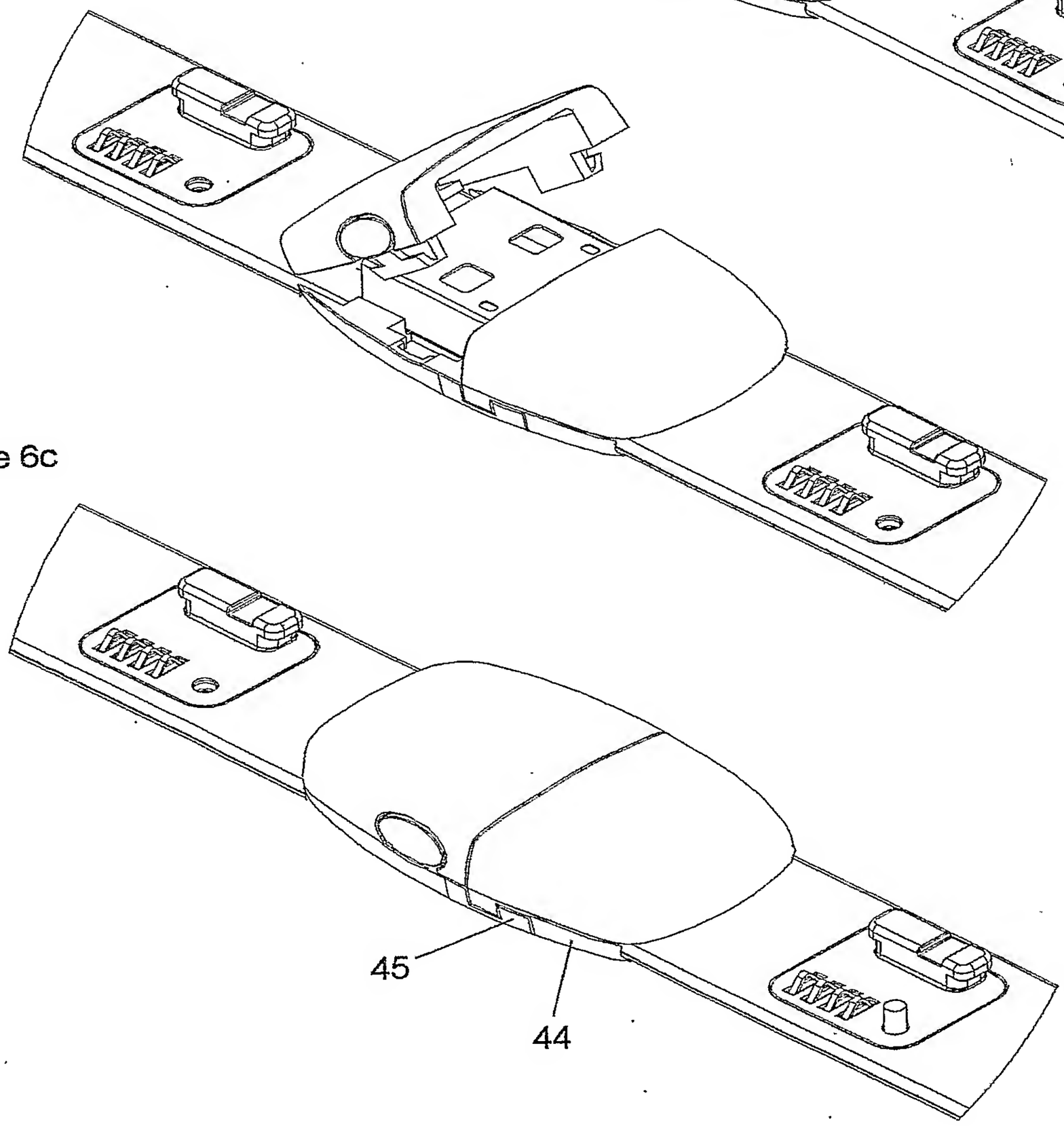
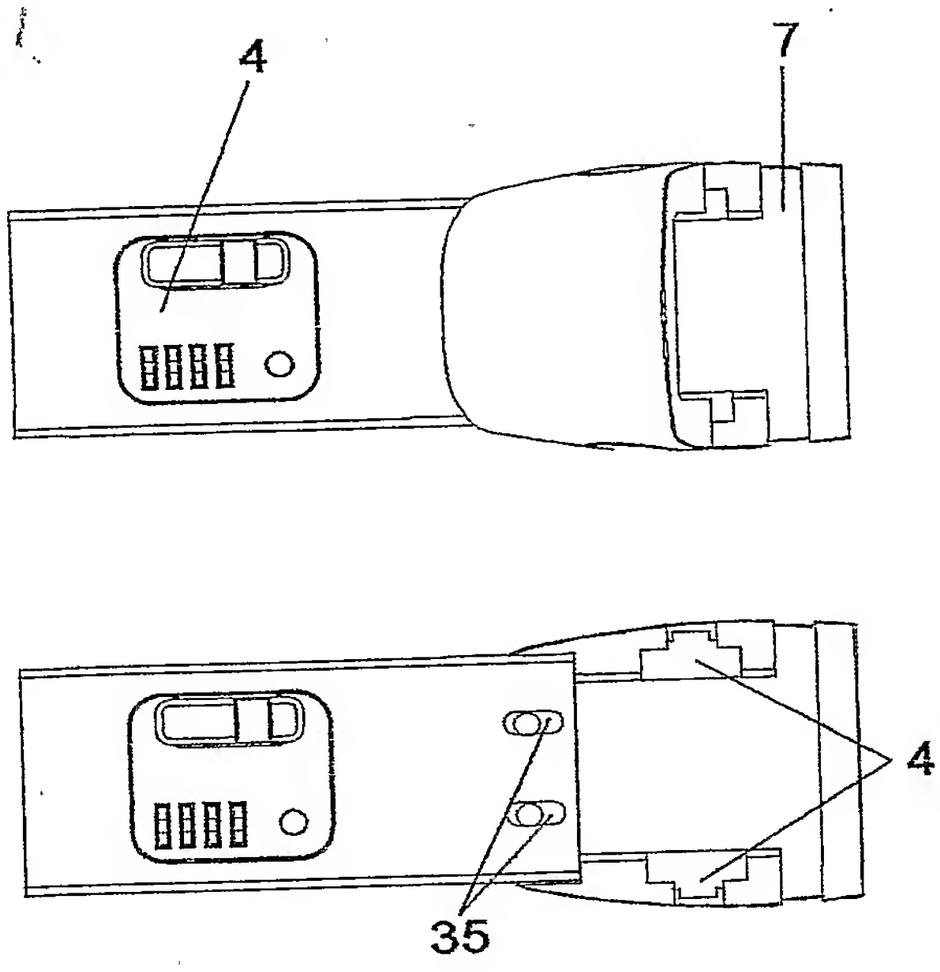


Figure 7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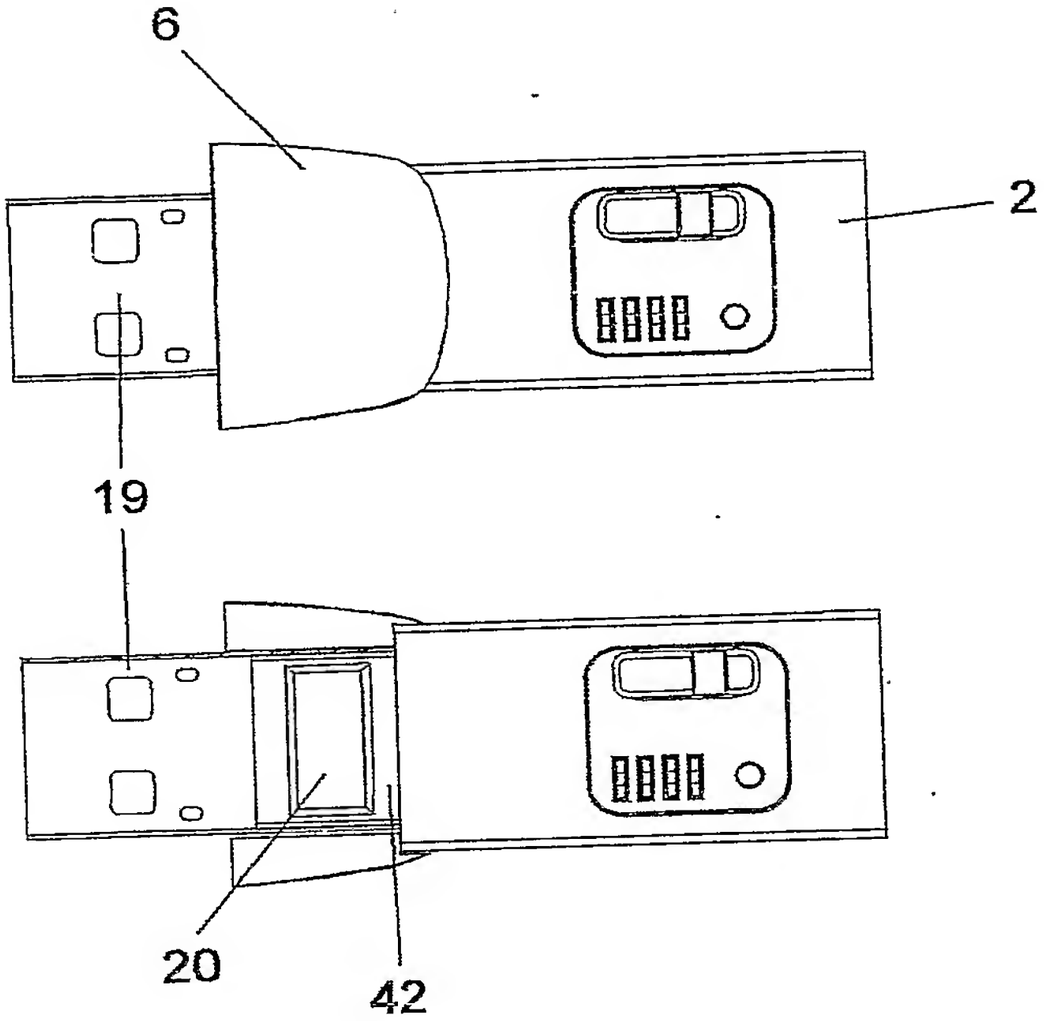
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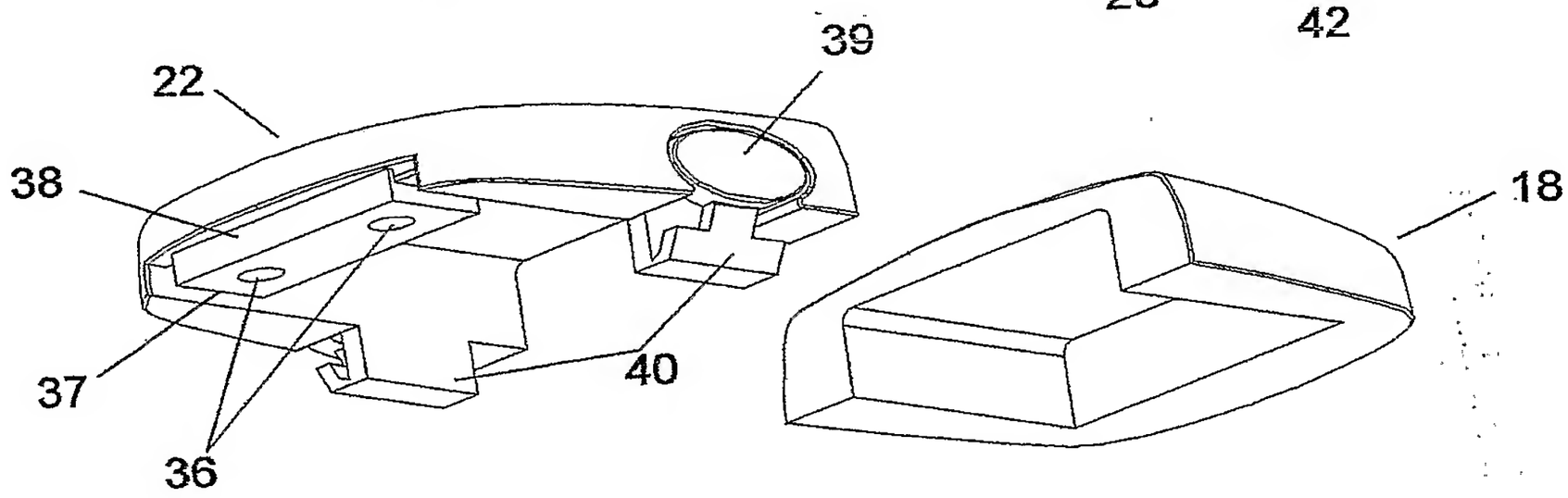
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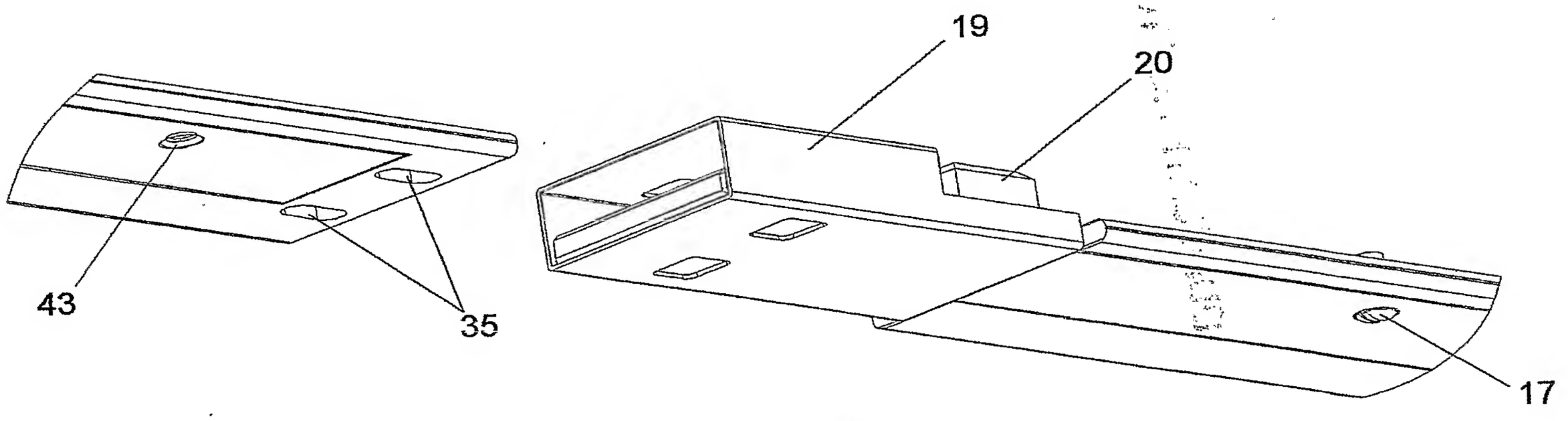
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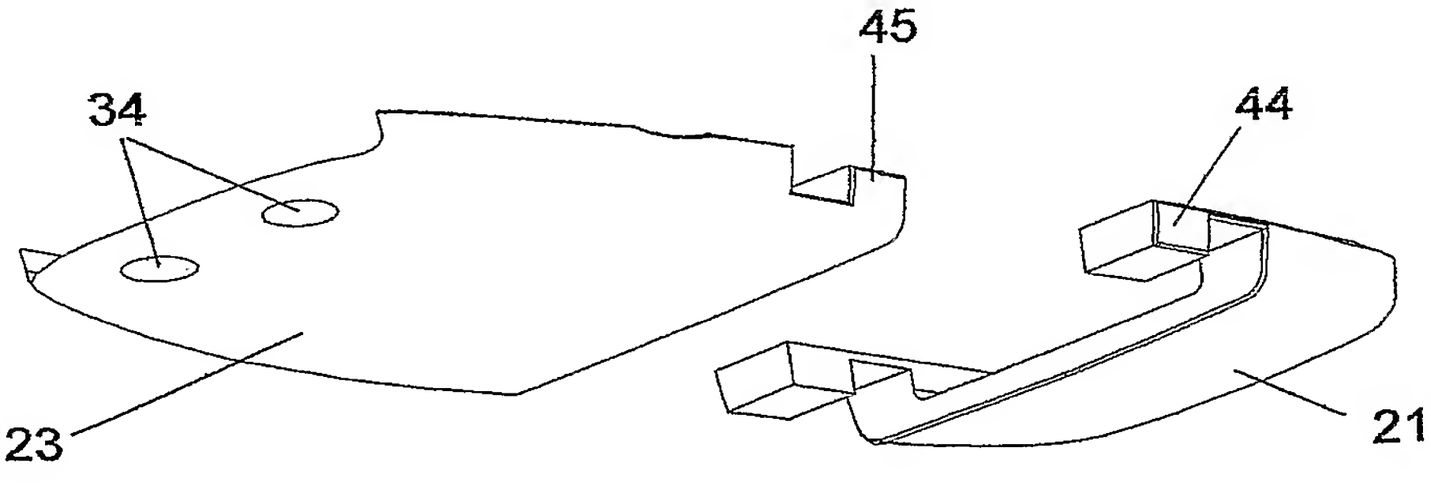
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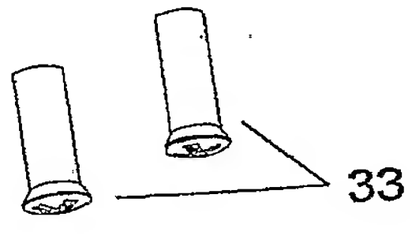
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Figure 8

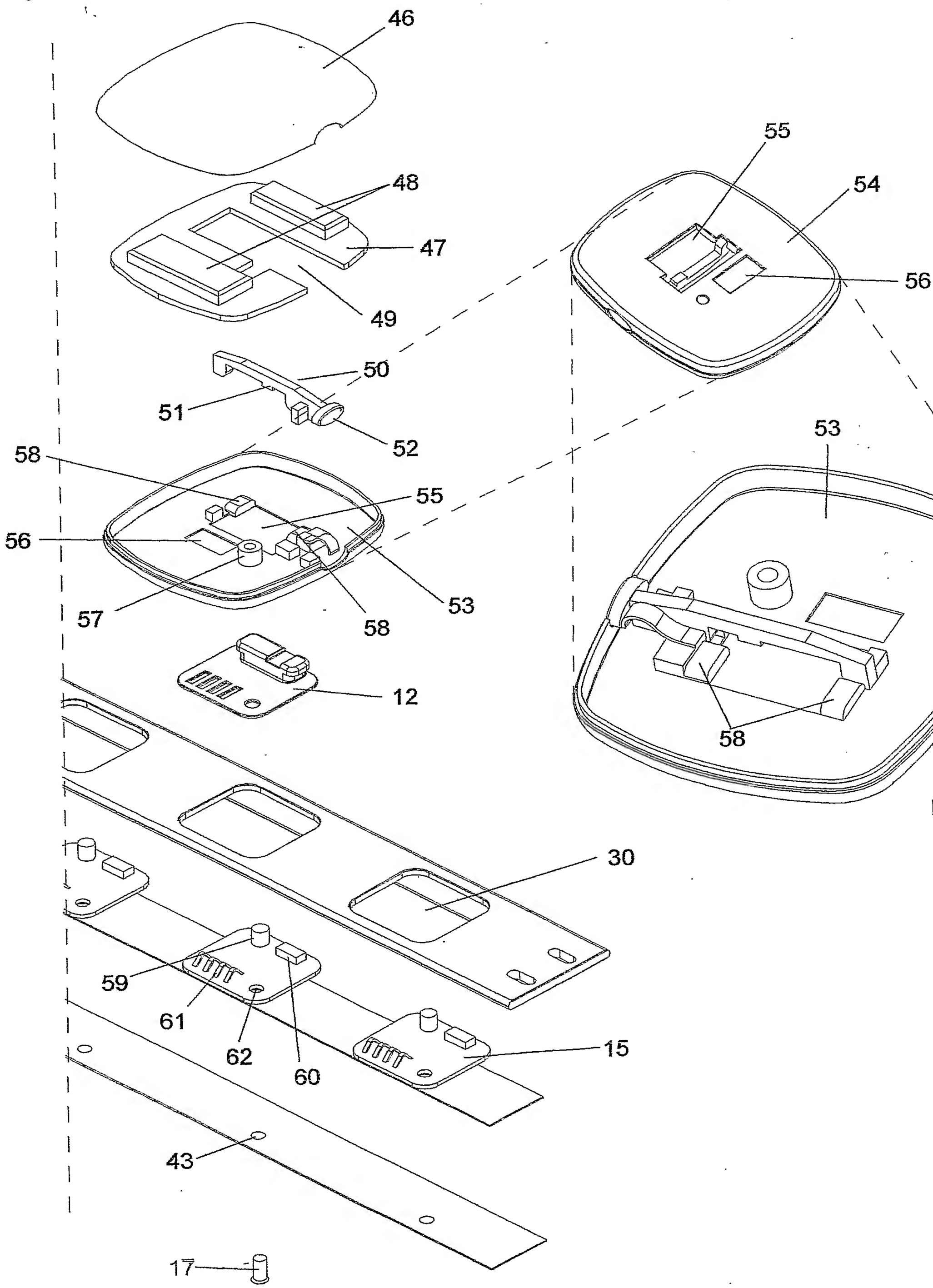

Figure 8b

Figure 9

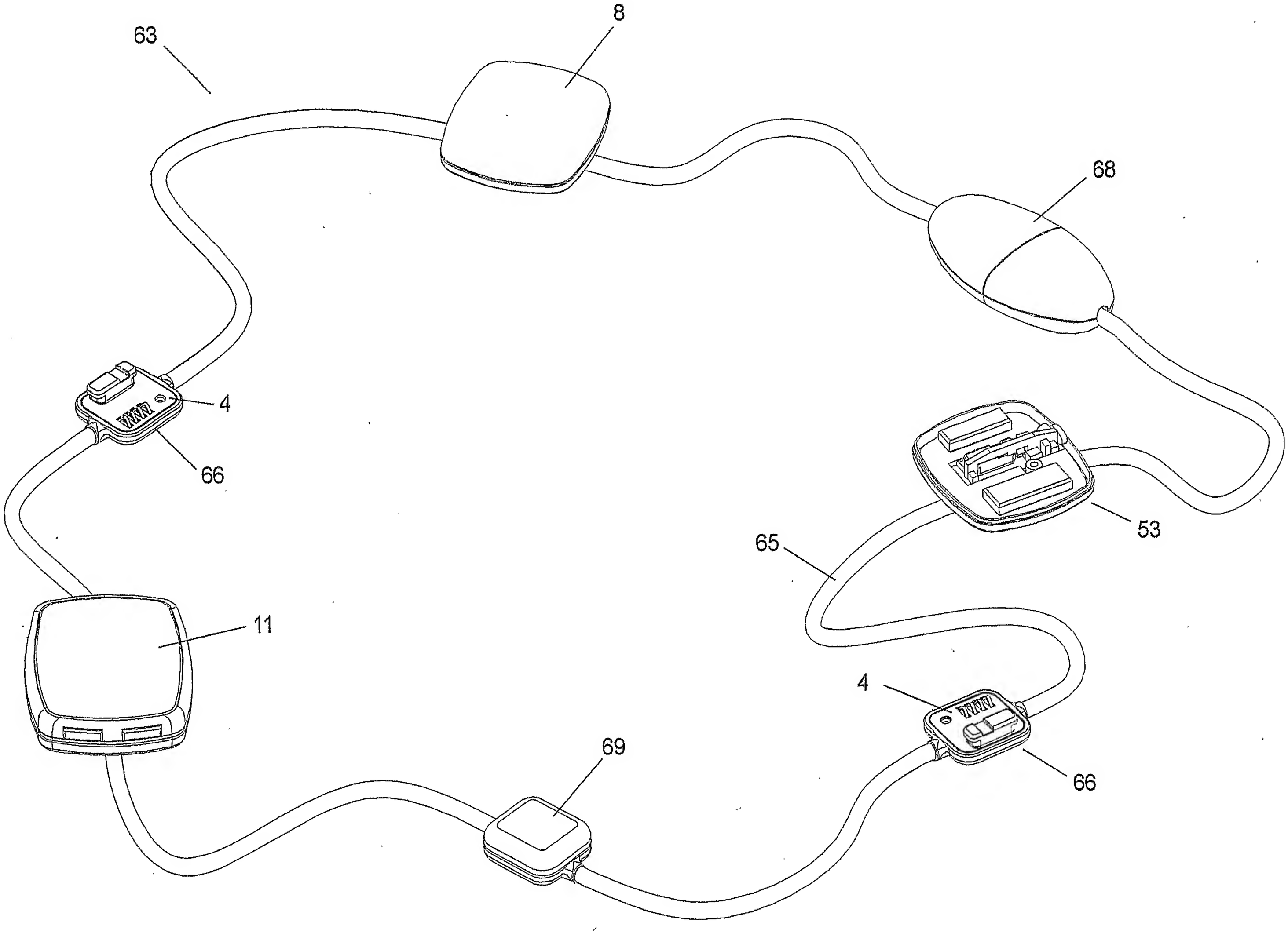

Figure 10